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## AN APPLICATION OF COST ACCOUNTING IN RATE-MAKING

Can the principles of cost accounting be applied consistently in the general field of transportation? This question has been asked many times in recent years, and it is assuming added interest now that the decisions both of the Supreme Court and of the Interstate Commerce Commission are tending strongly toward a separation of costs in the different lines of railway service. The complete solution of the problem is hardly to be expected at the present time, or perhaps even in the immediate future, but it is no exaggeration to say that two state investigations which have recently come to public notice represent at least a step in this direction. One of these is the Minnesota express rate case,<sup>1</sup> concluded as early as 1910. The other is the Wisconsin express rate case,<sup>2</sup> decided in May, 1913. The problem in these two cases was the same: to determine revenues and expenses in intrastate express business and from these to draw conclusions as to the reasonableness of local express rates. Both cases were based upon the cost principle, but, as will be seen, the cost principle was approached from different angles; and both gain their significance through the light they throw upon the possibilities of further application of this principle.

The Minnesota case followed throughout the so-called expense-unit method. In its essence it represented simply an effort to determine the expense of earning a dollar in intrastate express business and from this to deduce the reasonableness, or the unreasonableness, of the express rates in force in the state. Stated more broadly, the procedure was to determine the value of all property used in business assignable to the state, to apportion state revenues and state expenses, and to calculate the return on the investment.

<sup>1</sup> Minnesota Railroad and Warehouse Commission: *State of Minnesota vs. Wells, Fargo & Co., Express.*

<sup>2</sup> Railroad Commission of Wisconsin: *Merchants' and Manufacturers' Association of Milwaukee vs. Wells, Fargo & Co. et al.*

The significance of this case lies chiefly in its contribution to the methods of determining state revenues and state expenses in the express business. The railroad side of express transactions was introduced only incidentally, and somewhat superficially, to show that the percentage of gross earnings paid to the railroad company was unduly high. Moreover, the procedure in the case as a whole was open to three main objections, one of which at least is serious. These objections were: (1) the extensive use of estimates and apportionments when actual figures were available, (2) alleged inaccuracy arising in the translation of accounts from a monthly to a yearly basis, and (3) the inclusion in Minnesota revenues of earnings from business other than transportation conducted entirely outside of the state.<sup>1</sup>

The Wisconsin case was based upon the cost-unit principle and represents in many ways the most consistent and far-reaching application of this principle that has yet been made in the practice of rate-making and rate-judging. The object here was to test the reasonableness of express rates in the state, not only by a comparison of revenues and expenses, but by a direct calculation of the actual cost of carrying a pound, or more conveniently a hundred-weight, of express matter in the ordinary course of express business. This procedure involved, on the express side, a determination of the investment in Wisconsin business, an apportionment of revenues and expenses to the state, a division of the latter into intrastate, interstate, and transstate, and a computation of shipment costs, weight costs, and the express portion of movement costs. On the railroad side, it involved a determination of the railroad investment in the state, a division of the freight and passenger business on the whole line and a subdivision of the latter between the whole line and the state, a separation of passenger and express revenues and expenses, and a calculation of movement costs and the railroad portion of weight costs and shipment costs. From these calculations an effort was made to construct a schedule of rates running to the actual costs of the services performed and including allowance for taxes, working capital, and a return of 7 per cent on investment.

<sup>1</sup> For a full discussion of this case see the *Journal of Accountancy*, February, 1915, pp. 107-17.

The investigation in the case was made to cover the business of all the express companies operating in the state, but the calculations were based more specifically upon the operations of Wells, Fargo & Company and the Chicago, Milwaukee & St. Paul Railroad. Some of the difficulties which arose in the Minnesota case were avoided. The period chosen for consideration was the entire fiscal year ending June 30, 1910, direct allocations were made whenever reliable figures were available, and earnings from business other than transportation were included, in the main, only when they accrued within the state.

The chief purpose of the investigation was, of course, to determine the reasonableness of the express rates and the adequacy of the express service in the state of Wisconsin. Much of the material introduced into the case was devoted to this side of the subject. Interesting as this material is, and important as it is from the general standpoint of express rates and practices, it would seem best for present purposes to put it to one side and simply to trace through the application of the cost principle.

As the item of gross earnings figured in a number of the cost apportionments, the first important step in the computation was to determine the revenues, both express and railroad, attributable to the state and divisible between whole line and state, between state and intrastate, and between the different lines of transportation service. Applied to express revenues this consisted in a calculation of the Wisconsin portion of the earnings from all operations touching the state and a separation of these earnings on the basis of interstate and intrastate transactions. On the railroad side it consisted in a determination of freight and passenger earnings for the whole line, a determination of freight and passenger earnings in the state of Wisconsin, and a separation of passenger earnings into revenues derived from express operations and revenues derived from other sources—passenger traffic, mail, outside operations, etc. The separations in both cases were made mainly by means of direct allocations; that is, from the books and special reports of the companies, checked and tested by experts in the employ of the Commission. There were a few exceptions. In the express business revenues from money orders, travelers'

checks, and telegraphic transfers were divided between state and intrastate on the basis of previously allocated terminal expenses, and in the railroad business a few miscellaneous items were divided between the whole line and Wisconsin on an overhead basis.

A similar preliminary step was necessary in connection with the number of express waybills for the year ending June 30, 1910, the latter being used in separating several of the expense items in the express business and farther on in computing the number of shipment handlings. In order to determine the number of waybills an actual check of the various express agencies in the state was made for the months of June, July, and August, 1910, and the average charge per waybill thus ascertained was applied to the total charges for the year. The data in connection with other bases of apportionment were made up partly by independent calculations, but mainly from the reports of the companies concerned.

The great problem of the investigation, however, lay in the effort to find and apply these bases in an equitable way in apportioning expense accounts to the different lines of railway and express service. The details which this separation involved have been mentioned in a general way in a preceding paragraph. In effecting this division of accounts three main principles were taken as starting-points: (1) direct allocations were made whenever the nature of the accounts was such as to make these allocations possible; (2) accounts which fluctuated materially from year to year were made up from an average of the two years ending June 30, 1909, and June 30, 1910; (3) apportionments followed the general accounting principle that accounts incapable of direct allocation may be apportioned on the basis of the accounts to which they are most closely related.

On the express side the task presented no unusual difficulties. It consisted mainly in a consideration of the forty-eight primary items of expense and a division of the accounts, together with taxes and return on investment, between whole line and state and between state and intrastate. A number of these accounts were allocated directly and most of the rest were found to be capable of apportionment on such bases as revenues, overhead, and waybills. The extent to which direct allocations were made is indicated

by the fact that \$291,227.85 was so allocated out of a total operating cost in the state of \$377,435.14. In both the railroad and the express business accounts were occasionally separated partly by direct allocation and partly by apportionment.

On the railroad side the problem was more complex. Specifically the separation here involved the following calculations and apportionments: (a) freight and passenger expenses on the whole line; (b) operating expenses incident to express on the whole line; (c) freight and passenger operating expenses in Wisconsin; (d) operating expenses incident to express in Wisconsin; (e) operating expenses incident to intrastate express in Wisconsin; (f) taxes and return on investment. It is natural that in the separation of these accounts recourse should have been had more frequently to special calculations and to apportionments on a more or less arbitrary basis. When we consider, however, the complexity of the problems involved and the variety of the interests represented, the number of such apportionments seems remarkably small. Omitting the division of expenses between the whole line and Wisconsin, which was based upon figures furnished by the company and tested and approved by the representatives of the Commission, the great majority of the apportionments were made upon five main bases: (a) ton-miles; (b) overhead; (c) gross earnings; (d) revenue train-miles; (e) car-miles. These bases were derived and applied in connection with the following controlling considerations: (1) accounts varying with the amount of traffic were apportioned on the basis of ton-miles; (2) accounts which are independent of the amount of traffic, or which may be regarded as independent expenses belonging to several lines of service, were apportioned on the basis of gross earnings, the theory being that, laying aside the logical difficulty involved, each service should contribute to these expenses in proportion to its revenue; (3) certain accounts of a general nature were apportioned on an overhead basis. It is only fair to add that in the records of the investigation the reasons for each apportionment are fully and ably explained.

The story of the apportionments can best be read in Tables I and II. It is necessary, however, to warn the reader that these tables do not tell the whole story and that they should not be



	30. Train Supplies and Expenses	31. Transfer Employees	32. Transfer Supplies and Expenses	33. Stationery and Printing	34. Loss and Damage— Freight	35. Loss and Damage— Money	36. Damage to Property	37. Injuries to Persons	38. Other Expenses
Whole Line and Wisconsin..	Overhead to 29	Actual	Actual	Overhead to 22-32	Revenues	Revenues	Overhead to 22-32	Overhead to 22-32	Overhead to 22-32
State and Intrastate.....	Ton-miles	Waybills	Waybills	Overhead to 22-32	Revenues	Revenues	Overhead to 22-32	Overhead to 22-32	Overhead to 22-32

## IV. GENERAL

	41-48
Whole Line and Wisconsin.....	Overhead to 1-38
State and Intrastate.....	Overhead to 1-38

## B. Taxes

Whole Line and Wisconsin.....	Actual
State and Intrastate.....	Overhead to 1-38

## C. Return on Investment

Whole Line and Wisconsin.....	Actual
State and Intrastate.....	Overhead to 1-38

\* Average, 1909 and 1910.

† Accounts 2, 3, 8, 10, 16, 23, 25, 26, 27, and 28 represent terminal expenses and were here apportioned *en bloc*.

‡ And Wisconsin mileage.



made the basis of criticism on that account. Details have necessarily been omitted, and the tables have been inserted to indicate the trend of apportionments, rather than to show the actual apportionment in any specific instance.

The estimate of expenses included, as we have seen, taxes and a return of 7 per cent on investment. Taxes offered no particular difficulty, being computed directly from sums actually assessed and paid in. In determining the investment in the state, the Commission did not at this point enter upon the intricate problem of valuation. For the express company the valuation of physical property was taken at its cost, or inventory, value as derived from the tax commission reports for 1909 and 1910, and the balance of current assets and materials and supplies on hand were apportioned to the state on the basis of operating expenses. The value of the railroad property was based upon previous records of the Commission, and is described as "the cost of reproduction new of all operations in Wisconsin."<sup>1</sup> These items were apportioned to the various lines of service on the basis of operating expenses.

From the foregoing calculations it was possible to ascertain the total express company costs and the total common carrier costs which arose in connection with express operations in Wisconsin. The specific figures were as follows:

State:

Express company costs.....	\$393,570.00
Common carrier costs.....	302,106.00
Total costs.....	<hr/> \$695,576.00

Intrastate:

Express company costs.....	\$185,573.17
Common carrier costs.....	87,300.00
Total costs.....	<hr/> \$272,873.17

These figures disregard, of course, the claim of the express company that the 55 per cent of gross earnings paid for service rendered by the railroads should be included as a part of its costs. On this point, the Commission took the position that movement costs are evidently higher in interstate business, and that even granting that reasonableness of the payment for the company as a whole should

<sup>1</sup> Opinion, p. 33.

## I. Maintenance of Way and Structures

	1. Superintendence	2. Ballast*		3. Ties		4. F
		1/8	7/8	1/5	4/5	
Whole Line, Freight and Passenger . . . . .	Overhead	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Revenue train-miles
Whole Line, Passenger and Express . . . . .	Overhead	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles
Whole Line and Wisconsin . . . . .						
Wisconsin, Freight and Passenger . . . . .	Overhead	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Revenue train-miles
Wisconsin, Passenger and Express . . . . .	Overhead	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles
Wisconsin, Express and Intra-Express . . . . .	Overhead	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles

## II. Maintenance of Equipment

	24. Superintendence	25. Steam Locomotive Repairs	26. Steam Locomotive Renewals	27. Steam Locomotive Depreciation	31. Passenger Car Repairs	32. Passenger Car Renewals	33. Passenger Car Depreciation	34. Freight Car Rep
Whole Line, Freight and Passenger . . . . .	Overhead	Locomotive perfection sheets	.....	Overhead to 25	Passenger	Passenger	Passenger	Freight
Whole Line, Passenger and Express . . . . .	Overhead	.....	.....	Overhead to 25	Special	Overhead to 31	Overhead to 31	.....
Whole Line and Wisconsin						Apportioned on the basis of figures for		
Wisconsin, Freight and Passenger . . . . .	Overhead	Locomotive perfection sheets	.....	Overhead to 25	Passenger	Passenger	Passenger	Freight
Wisconsin, Passenger and Express . . . . .	Overhead	Ton-miles	.....	Overhead to 25	Special	Overhead to 31	Overhead to 31	.....
Wisconsin, Express and Intra-Express . . . . .	Overhead	Ton-miles	.....	Ton-miles	Ton-miles	Ton-miles	Ton-miles	.....

## IV. Transportation

	61. Superintendence	62. Dispatching Trains	63. Station Employees	64. Weighing and Car Service Associations	65. Coal and Ore Docks	66. Station Supplies and Expenses	67-76. Yard Operation Accounts	80. Road Engine Men
Whole Line, Freight and Passenger . . . . .	Overhead	Train-hours	Special	Freight	Freight	Special	Arbitrary†	Locomotive perfection sheets
Whole Line, Passenger and Express	Overhead	Car-miles	.....	.....	.....	.....	Ton-miles§	Ton-miles
Whole Line and Wisconsin . . . . .								
Wisconsin, Freight and Passenger . . . . .	Overhead	Train-hours	Special	Freight	Freight	Special	Arbitrary†	Locomotive perfection sheets
Wisconsin, Passenger and Express . . . . .	Overhead	Car-miles	.....	.....	.....	.....	Ton-miles§	Ton-miles
Wisconsin, Express and Intra-Express	Overhead	Ton-miles	.....	.....	.....	.....	Ton-miles	Ton-miles

## V. General

Whole Line, Freight and Passenger . . . . .

Whole Line, Passenger and Express . . . . .

TABLE 11

CHICAGO, MILWAUKEE &amp; ST. PAUL RAILWAY: APPORTIONMENT

3. Ties		4. Rails		5. Other Track Material		6. Roadway and Track	7. Removal of Sand, Snow, and Ice	8. Tunnels	9. Bridges, Trestles, and Culverts	10. Unimproved
1/5	4/5	9/10	1/10	9/10	1/10					
Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Overhead to 2-5	Revenue train-miles	.....	Gross earnings	Gross earnings
Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Overhead to 2-5	Car-miles	.....	Gross earnings	Gross earnings
Apportioned on the basis of figures furnished by the company, checked and compared with										
Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Overhead to 2-5	Revenue train-miles	.....	Gross earnings	Gross earnings
Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Overhead to 2-5	Car-miles	.....	Gross earnings	Gross earnings
Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Overhead to 2-5	Ton-miles	.....	Gross earnings	Gross earnings

32. Passenger Car Repairs	33. Passenger Car Depreciation	34. Freight Car Repairs	35. Freight Car Renewals	36. Freight Car Depreciation	43. Work Equipment Repairs	44. Work Equipment Renewals	45. Work Equipment Depreciation	46. Shop Machinery and Tools	47. Power Plant Equipment
Passenger	Passenger	Freight	Freight	Freight	Overhead† to 1-23 and 93	Overhead to 43	Overhead to 43	Overhead to 25, 31, 34, and 43	.....
Overhead to 31	Overhead to 31	.....	.....	.....	Overhead† to 1-23 and 93	Overhead to 43	Overhead to 43	Overhead to 25, 31, and 43	.....
Apportioned on the basis of figures furnished by the company, checked and compared with similar apportionments for other states, etc.									
Passenger	Passenger	Freight	Freight	Freight	Overhead to 1-23 and 93	Overhead to 43	Overhead to 43	Overhead to 25, 31, 34, and 43	.....
Overhead to 31	Overhead to 31	.....	.....	.....	Overhead to 1-23 and 93	Overhead to 1-23 and 93	Overhead to 1-23 and 93	Overhead to 25, 31, and 43	.....
Ton-miles	Ton-miles	.....	.....	.....	.....	.....	.....	.....	.....

66. Station Supplies and Expenses	67-76. Yard Operation Accounts	80. Road Engine Men	81. Engine House Expenses	82. Fuel, Road Locomotives	83. Water, Road Locomotives	84. Lubricants, Road Locomotives	85. Other Supplies	88. Road Trainmen	89. Train Supplies and Expenses	90. Tow
Special	Arbitrary†	Locomotive perfection sheets	Overhead to 80, 82-85	Locomotive perfection sheets	Overhead to 82	Locomotive perfection sheets	Locomotive perfection sheets	Special	Special	Rev t
.....	Ton-miles§	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Special	Overhead to 88	Car
Apportioned on the basis of figures furnished by the company, checked and compared with										
Special	Arbitrary†	Locomotive perfection sheets	Overhead to 80, 82-85	Locomotive perfection sheets	Overhead to 82	Locomotive perfection sheets	Locomotive perfection sheets	Special	Special	Rev t
.....	Ton-miles§	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Special	Overhead to 88	Car
.....	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton

## V. General

	106. Salaries and Expenses, General Office	107. Salaries and Expenses, Clerks and Attendants	108. General Office Supplies and Expenses	109. Law Expenses	110. Insurance
Whole Line, Freight and Passenger .....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105
Whole Line, Passenger and Express .....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105

MILWAUKEE &amp; ST. PAUL RAILWAY: APPORTIONMENT OF EXPENSES

### III. Traffic

Work ment vals	45. Work Equipment Depreciation	46. Shop Machinery and Tools	47. Power Plant Equipment	48. Injuries to Persons	49. Stationery and Printing	50. Other Expenses	51-52. Joint Equipment (Bal.)		53. Superin- tendence	54. O Agen
and to	Overhead to 43	Overhead to 25, 31, 34, and 43	.....	Overhead	Overhead	Overhead	Overhead	Whole Line, Freight and Passenger.....	Overhead	Gross earn
and to	Overhead to 43	Overhead to 25, 31, and 43	.....	Overhead	Overhead	Overhead	Overhead	Whole Line, Passenger and Express.....	a) Expenditures not ma charged and apportion	
Apportionments for other states, etc.								Whole Line and Wiscon- sin.....	Apportioned on the bas states, etc.	
and to	Overhead to 43	Overhead to 25, 31, 34, and 43	.....	Overhead	Overhead	Overhead	Overhead	Wisconsin, Freight and Passenger.....	Overhead	Overhe
and to and 93	Overhead to 1-23 and 93	Overhead to 25, 31, and 43	.....	Overhead	Overhead	Overhead	Overhead	Wisconsin, Passenger and Express.....		
								Wisconsin, Express and Intra-Express.....		

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Office and es	109. Law Expenses	110. Insurance	111. Relief Department Expenses	112. Pensions	113. Stationery and Printing	114. Other Expenses	115, 116. General Administration, Joint Tracks, Yards, and Terminals
1-105	Overhead to 1-105	Overhead to 1-105	.....	.....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105
	Overhead to 1-105	Overhead to 1-105	.....	.....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105

13. Signals and Interlocking Plants, 1/4	14. Telegraph and Telephone Lines	15. Electric Power Transmission	16. Buildings, Fixtures, and Grounds	17. Docks and Wharves	18. Roadway, Tools, and Supplies	19. Injuries to Persons	20. Stationery and Printing	21. Other Expenses	22-23. Joint Yards, Etc. (Bal.)
Gross earnings	Gross earnings	.....	Overhead	Freight†	Overhead	Overhead	Overhead	Overhead	Overhead
Gross earnings	Gross earnings	.....	Overhead	.....	Overhead	Overhead	Overhead	Overhead	Overhead
Gross earnings	Gross earnings	.....	Overhead	Freight	Overhead	Overhead	Overhead	.....	Overhead
Gross earnings	Gross earnings	.....	Overhead	.....	Overhead	Overhead	Overhead	.....	Overhead
Gross earnings	Gross earnings	.....	Overhead	.....	Overhead	Overhead	Overhead	.....	Overhead

### III. Traffic

		53. Superintendence	54. Outside Agencies	55. Advertising	56. Traffic Association	57. Fast Freight Lines	58. Industrial and Immigration Bureau	59. Stationery and Printing	60. Other Expenses
	Whole Line, Freight and Passenger.....	Overhead	Gross earnings†	Passenger	Gross earnings†	.....	Gross earnings†	Overhead	Overhead
	Whole Line, Passenger and Express.....	a) Expenditures not made in interest of express service. All legal, office, and administrative expenses incurred in express service charged and apportioned under general expenses.							
	Whole Line and Wisconsin.....	Apportioned on the basis of figures furnished by the company, checked and compared with similar apportionments for other states, etc.							
	Wisconsin, Freight and Passenger.....	Overhead	Overhead	Passenger	Gross earnings†	.....	Gross earnings†	Overhead	Overhead
	Wisconsin, Passenger and Express.....			No apportionment. See a) above.					
	Wisconsin, Express and Intra-Express.....			No apportionment. See a) above.					

61. Telegraph and Telephone	97. Stationery and Printing	98. Other Expenses	99. Loss and Damage to Freight	100. Loss and Damage to Baggage	101. Damage to Property	102. Damage to Stock on Right of Way	103. Injuries to Persons	104-5. Operating Joint Tracks and Facilities (Bal.)	77-78. Operating Joint Yards and Terminals (Bal.)
Gross earnings	Overhead	Overhead	Freight	Passenger	Revenue train-miles¶	Revenue train-miles¶	Arbitrary	Overhead	Arbitrary
Gross earnings	Overhead	Overhead	.....	.....	Car-miles	Car-miles	Car-miles	Overhead	Car-miles
Gross earnings	Overhead	Overhead	Freight	Passenger	Revenue train-miles¶	Revenue train-miles	Arbitrary	Overhead	Overhead
Gross earnings	Overhead	Overhead	.....	.....	Car-miles	Car-miles	Car-miles	Overhead	Car-miles
Gross earnings	Overhead	Overhead	.....	.....	Ton-miles	Ton-miles	Ton-miles	Overhead	Ton-miles

114. Other Expenses	115, 116. General Administration, Joint Tracks, Yards, and Terminals
Overhead to 1-105	Overhead to 1-105
Overhead to 1-105	Overhead to 1-105

Wisconsin, Freight and Passenger . . . . .	Overhead	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Revenue train-miles
Wisconsin, Passenger and Express . . . . .	Overhead	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles
Wisconsin, Express and Intra-Express . . . . .	Overhead	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles

## II. Maintenance of Equipment

	24. Superintendence	25. Steam Locomotive Repairs	26. Steam Locomotive Renewals	27. Steam Locomotive Depreciation	31. Passenger Car Repairs	32. Passenger Car Renewals	33. Passenger Car Depreciation	34. Freight Car Repairs
Whole Line, Freight and Passenger . . . . .	Overhead	Locomotive perfection sheets	.....	Overhead to 25	Passenger	Passenger	Passenger	Freight
Whole Line, Passenger and Express . . . . .	Overhead	.....	.....	Overhead to 25	Special	Overhead to 31	Overhead to 31	.....
Whole Line and Wisconsin						Apportioned on the basis of figures for		
Wisconsin, Freight and Passenger . . . . .	Overhead	Locomotive perfection sheets	.....	Overhead to 25	Passenger	Passenger	Passenger	Freight
Wisconsin, Passenger and Express . . . . .	Overhead	Ton-miles	.....	Overhead to 25	Special	Overhead to 31	Overhead to 31	.....
Wisconsin, Express and Intra-Express . . . . .	Overhead	Ton-miles	.....	Ton-miles	Ton-miles	Ton-miles	Ton-miles	.....

## IV. Transportation

	61. Superintendence	62. Dispatching Trains	63. Station Employees	64. Weighing and Car Service Associations	65. Coal and Ore Docks	66. Station Supplies and Expenses	67-76. Yard Operation Accounts	80. Road Engine Men
Whole Line, Freight and Passenger . . . . .	Overhead	Train-hours	Special	Freight	Freight	Special	Arbitrary†	Locomotive perfection sheets
Whole Line, Passenger and Express . . . . .	Overhead	Car-miles	.....	.....	.....	.....	Ton-miles§	Ton-miles
Whole Line and Wisconsin . . . . .								
Wisconsin, Freight and Passenger . . . . .	Overhead	Train-hours	Special	Freight	Freight	Special	Arbitrary†	Locomotive perfection sheets
Wisconsin, Passenger and Express . . . . .	Overhead	Car-miles	.....	.....	.....	.....	Ton-miles§	Ton-miles
Wisconsin, Express and Intra-Express . . . . .	Overhead	Ton-miles	.....	.....	.....	.....	Ton-miles	Ton-miles

## V. General

Whole Line, Freight and Passenger . . . . .
Whole Line, Passenger and Express . . . . .
Whole Line and Wisconsin . . . . .
Wisconsin, Freight and Passenger . . . . .
Wisconsin, Passenger and Express . . . . .
Wisconsin, Express and Intra-Express . . . . .

\* In accounts 2, 3, 4, 5, and 13, the  
† Exclusive of mail and express.  
‡ Arbitrary and switching mileage.  
§ Express car.  
¶ Exclusive of switching.

Revenues	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Overhead to 2-5	Revenue train-miles	.....	Gross earnings	Gross earnings
Passenger	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Overhead to 2-5	Car-miles	.....	Gross earnings	Gross earnings
Freight	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Ton-miles	Gross earnings	Overhead to 2-5	Ton-miles	.....	Gross earnings	Gross earnings

32. Passenger Car Repairs	33. Passenger Car Depreciation	34. Freight Car Repairs	35. Freight Car Renewals	36. Freight Car Depreciation	43. Work Equipment Repairs	44. Work Equipment Renewals	45. Work Equipment Depreciation	46. Shop Machinery and Tools	47. Power Plant Equipment
Passenger	Passenger	Freight	Freight	Freight	Overhead † to 1-23 and 93	Overhead to 43	Overhead to 43	Overhead to 25, 31, 34, and 43	.....
Overhead to 31	Overhead to 31	.....	.....	.....	Overhead † to 1-23 and 93	Overhead to 43	Overhead to 43	Overhead to 25, 31, and 43	.....
Apportioned on the basis of figures furnished by the company, checked and compared with similar apportionments for other states, etc.									.....
Passenger	Passenger	Freight	Freight	Freight	Overhead to 1-23 and 93	Overhead to 43	Overhead to 43	Overhead to 25, 31, 34, and 43	.....
Overhead to 31	Overhead to 31	.....	.....	.....	Overhead to 1-23 and 93	Overhead to 1-23 and 93	Overhead to 1-23 and 93	Overhead to 25, 31, and 43	.....
Ton-miles	Ton-miles	Ton-miles	.....	.....	.....	.....	.....	.....	.....

66. Station Supplies and Expenses	67-76. Yard Operation Accounts	80. Road Engine Men	81. Engine House Expenses	82. Fuel, Road Locomotives	83. Water, Road Locomotives	84. Lubricants, Road Locomotives	85. Other Supplies	88. Road Trainmen	89. Train Supplies and Expenses	90. Town
Special	Arbitrary‡	Locomotive perfection sheets	Overhead to 80, 82-85	Locomotive perfection sheets	Overhead to 82	Locomotive perfection sheets	Locomotive perfection sheets	Special	Special	Rev t
.....	Ton-miles§	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Special	Overhead to 88	Car
Apportioned on the basis of figures furnished by the company, checked and compared with similar apportionments for other states, etc.										
Special	Arbitrary‡	Locomotive perfection sheets	Overhead to 80, 82-85	Locomotive perfection sheets	Overhead to 82	Locomotive perfection sheets	Locomotive perfection sheets	Special	Special	Rev t
.....	Ton-miles§	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Special	Overhead to 88	Car
.....	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton

## V. General

	106. Salaries and Expenses, General Office	107. Salaries and Expenses, Clerks and Attendants	108. General Office Supplies and Expenses	109. Law Expenses	110. Insurance
Whole Line, Freight and Passenger .....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105
Whole Line, Passenger and Express .....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	.....
Whole Line and Wisconsin .....	.....	Apportioned on the basis of figures furnished by the company, checked and compared with similar apportionments for other states, etc.			
Wisconsin, Freight and Passenger .....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105
Wisconsin, Passenger and Express .....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	.....
Wisconsin, Express and Intra-Express .....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105	.....

\* In accounts 2, 3, 4, 5, and 13, the first fraction represents "wear," the second "weather."

† Exclusive of mail and express.

‡ Arbitrary and switching mileage.

§ Express car.

¶ Exclusive of switching.

Revenue train-miles	.....	Gross earnings	Gross earnings	Gross earnings	Revenue train-miles	Revenue train-miles	Gross earnings	Gross earnings	.....	Overhead
Car-miles	.....	Gross earnings	Gross earnings	Gross earnings	Car-miles	Car-miles	Gross earnings	Gross earnings	.....	Overhead
Ton-miles	.....	Gross earnings	Gross earnings	Gross earnings	Gross earnings	Ton-miles	Gross earnings	Gross earnings	.....	Overhead

### III. Traffic

Work ment vals	45. Work Equipment Depreciation	46. Shop Machinery and Tools	47. Power Plant Equipment	48. Injuries to Persons	49. Stationery and Printing	50. Other Expenses	51-52. Joint Equipment (Bal.)		53. Superin- tendence	54. O Ager
d to	Overhead to 43	Overhead to 25, 31, 34, and 43	.....	Overhead	Overhead	Overhead	Overhead	Whole Line, Freight and Passenger.....	Overhead	Gross earn
d to	Overhead to 43	Overhead to 25, 31, and 43	.....	Overhead	Overhead	Overhead	Overhead	Whole Line, Passenger and Express.....	a) Expenditures not ma charged and apportion	
Apportionments for other states, etc.								Whole Line and Wiscon- sin.....	Apportioned on the bas states, etc.	
d to	Overhead to 43	Overhead to 25, 31, 34, and 43	.....	Overhead	Overhead	Overhead	Overhead	Wisconsin, Freight and Passenger.....	Overhead	Overhead
d to and 93	Overhead to 1-23 and 93	Overhead to 25, 31, and 43	.....	Overhead	Overhead	Overhead	Overhead	Wisconsin, Passenger and Express.....		
			.....					Wisconsin, Express and Intra-Express.....		

85. Other Supplies	88. Road Trainmen	89. Train Supplies and Expenses	90. Block and Tower Signals	91. Crossing Flagmen and Gatemen	92. Draw- Bridge Operations	93. Clearing Wrecks	94. Telegraph and Telephone	97. Stationery and Printing	98. Other Expenses	99. Los Dama Frei
Locomotive perfection sheets	Special	Special	Revenue train-miles¶	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Overhead	Overhead	Freight
Ton-miles	Special	Overhead to 88	Car-miles	Car-miles	Car-miles	Car-miles	Gross earnings	Overhead	Overhead	.....
of figures furnished by the company, checked and compared with similar apportionments for other states, etc.										
Locomotive perfection sheets	Special	Special	Revenue train-miles¶	Revenue train-miles	Gross earnings	Revenue train-miles	Gross earnings	Overhead	Overhead	Freight
Ton-miles	Special	Overhead to 88	Car-miles	Car-miles	Car-miles	Car-miles	Gross earnings	Overhead	Overhead	.....
Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Ton-miles	Gross earnings	Overhead	Overhead	.....

Office and es	109. Law Expenses	110. Insurance	111. Relief Department Expenses	112. Pensions	113. Stationery and Printing	114. Other Expenses	115, 116. General Administration, Joint Tracks, Yards, and Terminals
1-105	Overhead to 1-105	Overhead to 1-105	.....	.....	Overhead to 1-105	Overhead to 1-105	Overhead to 1-105
1-105	Overhead to 1-105	.....	.....	.....	.....	Overhead to 1-105	Overhead to 1-105
the basis of figures furnished by the company, checked and compared with similar apportionments for other states, etc.							
1-105	Overhead to 1-105	Overhead to 1-105	.....	.....	.....	Overhead to 1-105	Overhead to 1-105
1-105	Overhead to 1-105	.....	.....	.....	.....	Overhead to 1-105	Overhead to 1-105
1-105	Overhead to 1-105	.....	.....	.....	.....	Overhead to 1-105	Overhead to 1-105



Gross earnings	Gross earnings	.....	Overhead	Freight	Overhead	Overhead	Overhead	.....	Overhead
Gross earnings	Gross earnings	.....	Overhead	.....	Overhead	Overhead	Overhead	.....	Overhead
Gross earnings	Gross earnings	.....	Overhead	.....	Overhead	Overhead	Overhead	.....	Overhead

### III. Traffic

		53. Superintendence	54. Outside Agencies	55. Advertising	56. Traffic Association	57. Fast Freight Lines	58. Industrial and Immigration Bureau	59. Stationery and Printing	60. Other Expenses
	Whole Line, Freight and Passenger . . . . .	Overhead	Gross earnings†	Passenger	Gross earnings†	.....	Gross earnings†	Overhead	Overhead
	Whole Line, Passenger and Express . . . . .	a) Expenditures not made in interest of express service. All legal, office, and administrative expenses incurred in express service charged and apportioned under general expenses.							
	Whole Line and Wisconsin . . . . .	Apportioned on the basis of figures furnished by the company, checked and compared with similar apportionments for other states, etc.							
	Wisconsin, Freight and Passenger . . . . .	Overhead	Overhead	Passenger	Gross earnings†	.....	Gross earnings†	Overhead	Overhead
	Wisconsin, Passenger and Express . . . . .			No apportionment. See a) above.					
	Wisconsin, Express and Intra-Express . . . . .			No apportionment. See a) above.					

Telegraph and Telephone	97. Stationery and Printing	98. Other Expenses	99. Loss and Damage to Freight	100. Loss and Damage to Baggage	101. Damage to Property	102. Damage to Stock on Right of Way	103. Injuries to Persons	104-5. Operating Joint Tracks and Facilities (Bal.)	77-78. Operating Joint Yards and Terminals (Bal.)
Gross earnings	Overhead	Overhead	Freight	Passenger	Revenue train-miles ¶	Revenue train-miles ¶	Arbitrary	Overhead	Arbitrary
Gross earnings	Overhead	Overhead	.....	.....	Car-miles	Car-miles	Car-miles	Overhead	Car-miles
Gross earnings	Overhead	Overhead	Freight	Passenger	Revenue train-miles ¶	Revenue train-miles	Arbitrary	Overhead	Overhead
Gross earnings	Overhead	Overhead	.....	.....	Car-miles	Car-miles	Car-miles	Overhead	Car-miles
Gross earnings	Overhead	Overhead	.....	.....	Ton-miles	Ton-miles	Ton-miles	Overhead	Ton-miles

114. Other Expenses	115, 116. General Administration, Joint Tracks, Yards, and Terminals
Overhead to 1-105	Overhead to 1-105
Overhead to 1-105	Overhead to 1-105
Overhead to 1-105	Overhead to 1-105
Overhead to 1-105	Overhead to 1-105
Overhead to 1-105	Overhead to 1-105

not be questioned, it did not follow that 55 per cent would be the proper amount in intrastate business. Revenues on intrastate business amounted to \$355,611.14.

Now, an analysis of the expense accounts and the operations they represent revealed the fact that in the great majority of cases it was possible to separate the costs and to attribute them directly to the specific services performed as the shipments passed from consignor to consignee; in other words, that there was a fixed minimum cost applying to every shipment in each of its several stages of transportation. There was, for example, an initial expense for every shipment, which was practically the same whether the shipment weighed ten pounds or one hundred pounds and whether it traveled fifty miles or five hundred miles. Such services as weighing, receipting, way-billing, entering into accounts, and tracing in case of loss would be practically the same, regardless of weight or distance. This is also true of wagon service, though with important limitations. These costs clearly include the greater part of the express company expenses and only a small part of the railroad expenses, and the unit for costs of this kind is the shipment.

In addition to shipment costs there are also elements of cost which vary almost exclusively with weight. Weight evidently exerts a great influence upon cost in pick-up and delivery service and in handling shipments at stations and at transfer points. Both shipment costs and weight costs are largely terminal costs, and they make up a considerable portion of the express company expenses and a smaller portion of the railroad expenses. The unit here is the pound, or more conveniently the hundredweight.

The third element of cost varies with the distance the shipment moves. The element of weight is also a factor here and so this is more accurately called the weight-distance cost, representing the product of weight and distance. Naturally most of the railroad items come under this head. A small number of railroad expenses are, of course, independent of distance, and these are included in the specific costs attributed to shipment and weight. On the other hand, a few of the express company costs, such as transfer and messenger service, are influenced by length of haul, and these are accordingly included in movement costs. The commodity which the railroad is conceived as furnishing is in reality ton-miles, or

cubic-foot-miles; that is, "it moves cars containing a certain number of pounds or cubic feet of express matter a certain number of miles." It is probable that in the particular traffic which characterizes the express business size really affects movement cost more than does actual weight. Nevertheless weight may be accepted, with certain reservations, as a measure of space, and the unit of weight-distance cost thus becomes the pound-mile, or more conveniently the hundredweight-mile.

The foregoing are, to be sure, not the only cost elements in the express business. Other considerations affect the case, but they are of relatively small importance. The most important of these considerations are number of packages, risk, and size. Proper rules of aggregating cover any inequalities that may arise in connection with the number of packages. Risk is partly accounted for in weight and distance costs, and extraordinary conditions in this respect may be met by higher classifications. Size probably plays a greater part in cost than does actual weight, but weight is at any rate a rough measure of size, and for extremely bulky articles recourse may be had again to classification. In the great majority of cases, however, the three elements to be considered are shipment cost, weight cost, and weight-distance cost.

The problem, therefore, of constructing a schedule of rates running to the services in which the costs were incurred, resolved itself into a separation of the various expense accounts into the three costs named above and a determination of the number of shipment units, weight units, and weight-distance units represented in the Wisconsin business. This process, like that of apportioning expenses along the various lines of railway and express service, involved a vast amount of study and a multitude of considerations whose details must be omitted or else barely touched upon here.

For the purpose of deriving these costs the calculations were made to include the entire Wisconsin business, instead of the intrastate business alone. The reason for this was that the major portion of the Wisconsin costs were actual allocations, while the intrastate costs were, in the main, apportionments, and that the total Wisconsin costs were given in a manner better suited to cost-analysis purposes. Wisconsin costs included the terminal costs of intrastate and interstate business and the movement costs of intra-

state, interstate, and transstate business. The reduction of total costs to unit costs thus consisted in reducing the number of shipment units handled in Wisconsin to two-handling equivalents, to represent complete transactions, and in relating to them the total weight-distance units.

In order to separate these costs into their constituent elements, expense accounts were analyzed and arranged in groups, and the division then effected, in each instance, after a careful study of the operations involved and a relation of these operations to the number of shipments, to the weight of shipments, and to the product of the weight of the shipments and the distance they traveled. This involved the consideration and appraisal of a number of conflicting details such as the inclusion of money-order business and other non-express operations, the proportion of weight costs attributable to pick-up and delivery and again to actual movement, the railroad cost element in shipment and weight expenses, the express cost element in movement expenses, etc. The grouping of the expenses and the percentages of these expenses attributed to each of the cost items were as follows:

TABLE III

	Shipment	Weight	Weight-Distance
	Per Cent	Per Cent	Per Cent
A. Express company costs—			
Agency and office expenses . .	71	20	9.0
Wagon and stable . . . . .	70	30	0.0
Transfer and train . . . . .	21.4	21.4	57.2
Other expenses . . . . .	60.7	23.3	16.0
Taxes . . . . .	60.7	23.3	16.0
Return on investment . . . . .	60.7	23.3	16.0
B. Common carrier costs . . . . .	3.0	2.0	95.0
Total costs . . . . .	35.66	14.0	50.3

Total express company costs were thus divided as follows: shipment, \$238,994; weight, \$91,640; weight-distance, \$62,936. Common carrier costs were: shipment, \$9,063; weight, \$6,042; weight-distance, \$287,001. Combining the two gives the following distribution of the total costs of \$695,676: shipment, \$248,057; weight, \$97,682; weight-distance, \$349,937.

The total Wisconsin expenses having been distributed among shipment costs, weight costs, and weight-distance costs, the next

step was to determine the total number of shipment, weight, and movement units in the Wisconsin business. This was done separately for merchandise and "special" business.

The total number of shipment units was computed from shipment handlings for the fiscal year ending June 30, 1910. These last were based upon the number of waybills in Wisconsin business, estimated by applying the average charge per waybill as found by actual check for the months of June, July, and August, 1910, to the total charges for the year in question.

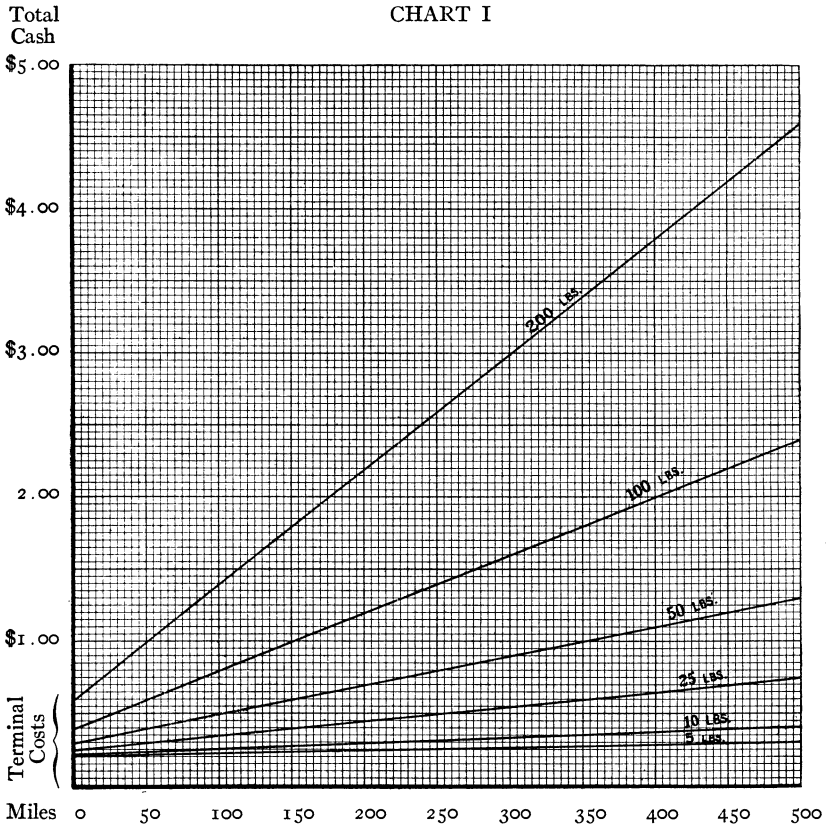
Weight units and weight-distance units were calculated separately for intrastate, interstate, and transstate business. In order to find the number of pounds and hundredweight miles of intrastate shipments an actual check of the largest agencies in the state was made for three days, and the average number of pounds per dollar and the average pound-mile per dollar thus obtained were applied to the total intrastate revenue for the year. These results were then averaged with results derived by applying the average pounds per shipment and the average length of haul to the total intrastate business for the year. Interstate units were derived in a similar way, except that the charges on interstate shipments were divided by two in order to place the shipments on a two-handling basis. Hundredweight-miles for transstate business were obtained by ascertaining the hundredweight-miles of this class of business for one week and calculating from this the business for the year. There were, of course, no terminal costs here and hence no shipment units or weight units. The number of shipments and the number of pounds thus include intrastate and interstate shipments, and hundredweight-miles include intrastate, interstate, and transstate shipments.

The total number of units in Wisconsin business were thus ascertained to be: shipment, 1,307,027; weight, 53,371,831; weight-distance, 94,392,654. By applying these figures to the total costs already shown the following separate costs were obtained:

Shipment . . . . .	18.95	cents per shipment
Weight . . . . .	0.1830	cent per pound
Weight-distance . . . . .	0.3707	cent per hundredweight-mile

The foregoing figures are based upon the assumption that merchandise and "special" business were equally costly to handle. The conditions under which the "special" business was handled, however, were such as to warrant the conclusion that this business

CHART I



is handled at smaller cost than the regular merchandise business. Calculations were made showing unit costs under various assumptions as to the percentage relation of the costs on special business to the costs on merchandise business, the figures varying from those given in the preceding paragraph to 21.41 cents per shipment and 0.2172 cent per pound. It seemed best, therefore, to use the nearest even figures in the construction of a tentative schedule. How the charges would run under the proposed system can be

seen from Table IV.<sup>1</sup> The general trend of a system of rates worked out on this basis is shown in Chart I. The fact should be kept in mind that both Table IV and the chart represent charges based upon fixed unit costs, without reference to practical considerations in connection with classification, distance, etc.

TABLE IV  
COST, IN CENTS, OF EXPRESS SHIPMENTS, CLASSIFIED BY WEIGHT OF PACKAGE  
AND BY DISTANCE

	WEIGHT OF PACKAGE					
	5 Lbs.	10 Lbs.	25 Lbs.	50 Lbs.	100 Lbs.	200 Lbs.
20 cents per shipment.....	20	20	20	20	20	20
0.2 cent per pound.....	1	2	5	10	20	40
Total terminal costs.....	21	22	25	30	40	60
Movement cost, 10 miles.....	0.2	0.4	1	2	4	8
Total cost, 10 miles.....	21.2	22.4	26	32	44	68
“ “ 20 “.....	21.4	22.8	27	34	48	76
“ “ 50 “.....	22	24	30	40	60	100
“ “ 100 “.....	23	26	35	50	80	140
“ “ 150 “.....	24	28	40	60	100	180
“ “ 200 “.....	25	30	45	70	120	220
“ “ 300 “.....	27	34	55	90	160	300
“ “ 400 “.....	29	38	65	110	200	380
“ “ 500 “.....	31	42	75	130	240	460

The records of the case contain many impressive facts concerning the incidence and amount of express charges in general, and concerning express practices in Wisconsin in particular. These facts have their place and uses, and their importance is not to be overlooked. The significant thing in the investigation, however, is the theoretical bearing it assumes through its consistent application of the cost principle and the apparent dependability of its results. It does not offer a complete solution of the problem of cost apportionment in the transportation service, but it does represent an important step in this direction; and without minimizing the exceptional difficulties that attend this cost separation, it shows that the task is neither so elusive nor so impossible of accomplishment as many authorities have been inclined to believe.

ROBERT H. TUCKER

UNIVERSITY OF WISCONSIN

<sup>1</sup> Made up from a similar table in the Opinion of the Commission, p. 39.